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THE NEW ENGLAND BOTANICAL CLUB

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CRITICAL BRYOPHYTES FROM THE KEWEENAW PENINSULA, MICHIGAN[1]

WILLIAM CAMPBELL STEERE

SEVERAL moss specimens from a collection made by the writer in Keweenaw County, Michigan, in July, 1933, were found to represent unfamiliar and puzzling species, and were put aside for study after further field work had made more material available. Opportunity for further study in the Keweenaw area did not come until 1935, when the first two weeks of September were spent in the field in northern Houghton County and in the more accessible parts of Keweenaw County. Most of the coast line of Lake Superior from Eagle Harbor to a point beyond Horseshoe Harbor was traversed, as well as much of the inland region. The dense forest north of Fort Wilkins was most thoroughly studied. The eastern shore of the peninsula was visited at Jacobsville, and again in the vicinity of Bête Gris.

Professor Fernald[2] has published an important report upon the vascular plants which he collected in Keweenaw County in the summer of 1934. He has pointed out that parts of the Keweenaw Peninsula possess, in addition to the usual floristic elements normally present in northern Michigan, a well-marked element of isolated Rocky Mountain and west coast species of ferns and flowering plants. As a result of his discovery, Fernald includes the higher parts of Keweenaw County among the driftless or unglaciated areas which he has previous-

[1] Papers from the Department of Botany and the Herbarium of the University of Michigan, No. 595.

[2] Fernald, M. L., *Critical plants of the upper Great Lakes region of Ontario and Michigan*, RHODORA 37: 197–222, 238–262, 272–301, 324–341, plates 352–379. 1935.

ly identified in eastern North America through tracing similar anomalies of plant distribution.

During the 1935 field season an especial search was made for isolated western species of bryophytes, of which two species had already

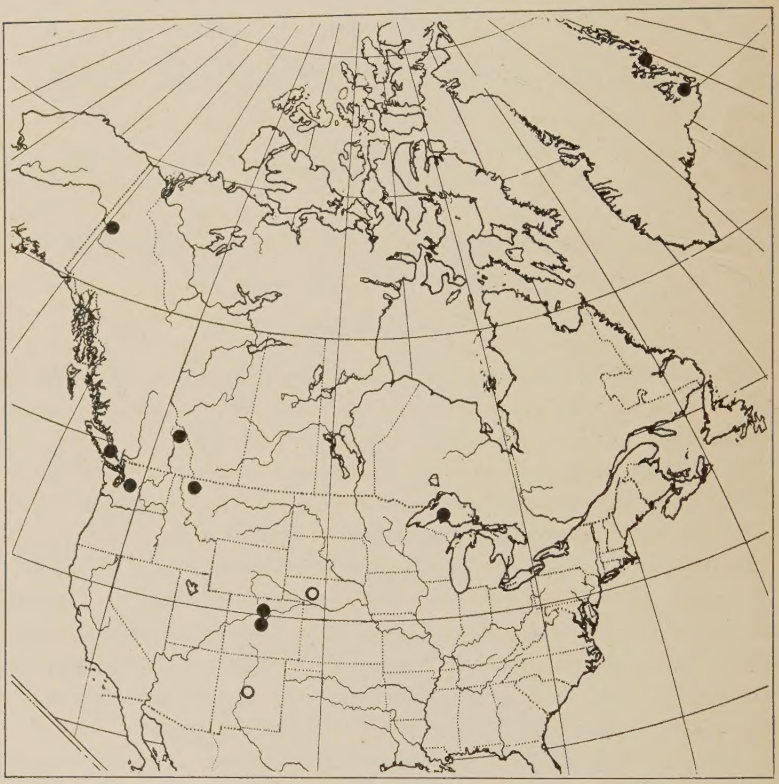

FIG. 1. American Range of TIMMIA AUSTRIACA.

been collected in 1933. The search was well rewarded, and it can be established here that there is a strong element of Cordilleran, Pacific coast, and arctic species in the bryophyte flora of Keweenaw County. This situation is especially interesting because it is not generally known nor admitted that the distribution of bryophytes parallels in general that of phanerogams and pteridophytes.

From among the assemblages of arctic-alpine, trans-continental-boreal, and other interesting geographical and ecological groups of

bryophytes, the following species from the Keweenaw Peninsula may be selected as being critical (in the geographical sense of Fernald); *Jungermannia Schiffneri* (Loitles.) Evans (Fig. 4), *J. sphaerocarpa* Hook., *Lophozia obtusa* (Lindb.) Evans, *Scapania cuspiduligera* (Nees) K. Müll., *Frullania Bolanderi* Aust. (type specimen from San Francisco) (Fig. 5), *Timmia austriaca* Hedw. (Fig. 1), *Pseudoleskea oligoclada* Kindb. (type specimen from Vancouver Island) (Fig. 3), and *Hygrohypnum molle* (Dicks.) Loeske. All these have been known previously on this continent only from the Rocky Mountains or the Pacific Coast, or both.

Although this list of Cordilleran and west-coast species is not a very extensive one, when compared numerically with the list of "critical" phanerogams and ferns given by Fernald, the discrepancy may be explained readily on at least two grounds. In the first place, the inconspicuousness of mosses and hepatics, especially in dry weather, prevents the collector from getting every species on his first inspection of an area. In the second place, when one considers the disparity in the sizes of the two groups, the list of "critical" bryophytes becomes proportionately nearly as large as that of phanerogams and ferns. The total number of species of bryophytes in any one county, even under the most favorable conditions, probably does not exceed 300, whereas there may be as many as 1500 species of flowering plants and ferns.

It is apparent, then, that the geographic distribution of vascular plants, which Fernald uses as a proof of the absence of recent glaciation, is almost exactly paralleled by the distribution of the bryophytes. It is difficult to determine just how much support is given to Fernald's thesis by this discovery. Very little is known of the *exact* distribution of bryophytes, and of the influence of glaciation upon them. There is no more than presumptive evidence that the bryophytes of Keweenaw County have not migrated there in post-glacial times. The bryophyte floras of the various driftless areas have not been studied intensively, and we do not know, consequently, to what extent the species may be regarded as trustworthy indicators of areas which have escaped glaciation. Notwithstanding my sympathy with Fernald's ideas, I do not consider that there is enough evidence based entirely on the distribution of mosses and hepatics to enable a cautious bryologist to conclude that parts of Keweenaw County escaped glaciation. The geological evidence cited by Fernald is very sound, and easily

observed by visitors to Keweenaw County. His conclusion that parts, at least, of Keweenaw Peninsula are unglaciated, will probably prove to be justified, if one may judge by the long series of similar proposals which he has made and which have become generally accepted, although many of his propositions were as startling as this one, when first published.

The possibility that other higher areas along the south shore of Lake Superior may also have escaped glaciation is indicated by the presence there of a significant number of Cordilleran species. Thus the list of "critical" species from the Keweenaw area is well supplemented by collections from the adjoining highlands of northern Michigan. Dr. Nichols[1] has reported *Grimmia patens* (Hedw.) Bry. Eur. [*Rhacomitrium patens* (Hedw.) Hüben.] from the Huron Mountains of Marquette County. This species, according to the most recent monograph of the family,[2] has the following distribution: "Greenland to Alaska, British Columbia, Washington, Oregon, Idaho, and Montana." From a further exploration of the Huron Mountains in 1936 Dr. Nichols reports (personal communication) *Grimmia Hartmani* Schimp. var. *anomala* (Hampe) Mönk. Jones (*l. c.*) gives the known distribution of this moss as follows: "On the divide between Traille River and Independence Creek, Idaho, altitude 6,000 feet . . . This is apparently the only record for North America."

In late August, 1935, Dr. Nichols and I, collecting together in the Porcupine Mountains, found three western bryophytes, which have also been collected by myself in Keweenaw County. These species are *Frullania Bolanderi* Aust., *Pseudoleskea oligoclada* Kindb. (FIG. 3), and *Hygrohypnum molle* (Dicks.) Loeske.

Since the report[3] dealing with the Porcupine Mountain bryophytes went to press, Mr. Bartram has very kindly identified several additional specimens from the Porcupine Mountains which had puzzled me very much. As a result, *Tortula intermedia* (Brid.) Berk.,[4] another

[1] Nichols, G. E., *The bryophytes of Michigan with special reference to the Huron Mountain region*, Bryologist **38**: 11–19, 1935.

[2] Jones, G. N., *Grimmiaceae*, Moss Flora of North America **2** (1): 1–65, 25 pl., 1933.

[3] Nichols, G. E. and W. C. Steere, *Bryophytes of the Porcupine Mountains, Ontonagon County, Michigan*, Papers Mich. Acad. Sci., Arts & Lett., 1937 (in press).

[4] *Tortula intermedia* (Brid.) Berk., Handbook Brit. Mosses, p. 251, 1863 (*Syntrichia intermedia* Brid., Bryol. Univ., **1**: 586, 1826) is much more commonly called *T. montana* (Nees) Lindb., Musc. Scand., p. 20, 1879 (*Syntrichia montana* Nees, Flora **2** (1): 301, 1819). The name in this sense is quite invalid, however, because of the existence of *Tortula montana* Mitt., Musc. austro-Amer., p. 156, 1869, even though it is now placed in *Barbula* [*B. montana* (Mitt.) Jaeg., Ber. St. Gall. Naturw. Ges. 1871–72: 424, 1873].

western species, may be added to the Michigan flora. It was collected along the shore of Lake Superior at the foot of the Porcupine Mountains, in Ontonagon County. *Leptobarbula berica* (De Not.) Schimp., an apparently very rare species, which has been reported in North America only from the northern Rocky Mountains, may be added

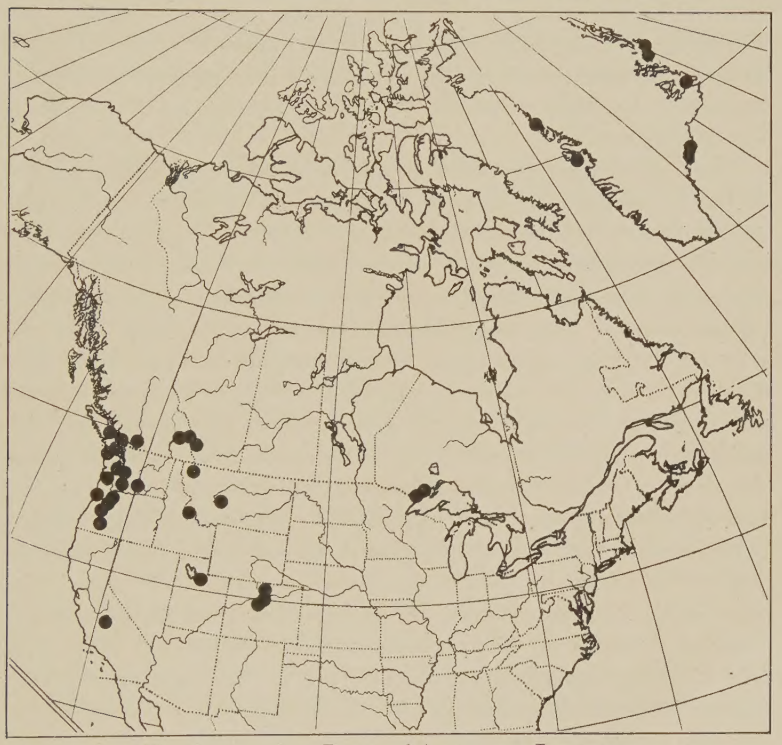

FIG. 2. American Range of ASTERELLA LUDWIGII.

tentatively, as the result of a somewhat doubtful determination of material from the Porcupine Mountains. Even the highlands on the west shore of Lake Superior yield significant species of bryophytes. Perhaps the one of most interest is *Asterella Ludwigii* (Schwaegr.) Underw. (FIG. 2), which in the most recent monograph[1] is given this distribution: "Greenland; Montana to British Columbia, and southward to Colorado and California." In 1927[2] it was reported from

[1] Evans, A. W., *Rebouliaceae*, North Amer. Flora, **14**: 39–56, 1923.

[2] Conklin, G. H., *Collecting hepatics along Lake Superior in northern Minnesota*, Bryologist **30**: 6–8, 1927.

Middle Falls, Pigeon River, Ontario, and in 1928[1] from the American side of the Pigeon River, in Cook County, Minnesota. A careful survey of the higher parts of the same region might reveal other species of significant distribution. A related species, *Asterella saccata* (Wahlenb.) Evans has a similar distribution (FIG. 6). In 1923 Evans[2] gave as its distribution: "Yukon, British Columbia, Idaho, and Washington." In 1929,[3] this hepatic was reported from Winona, Minnesota, which is within the best known and unquestioned driftless area. The similar distribution of these two species of *Asterella* is very significant.

After seeing the remarkable parallelism of bryophyte distribution to that of vascular plants on the Keweenaw Peninsula, it is perhaps safe to predict that the converse is true, and that some of the conservative Cordilleran phanerogams will be found eventually in other areas along the Lake Superior shore. It is even possible to cite some geological evidence that other parts of northern Michigan than the northeast end of the Copper Range possibly escaped glaciation. Evidences of the last stages, at least, of the Wisconsin ice invasion are inconspicuous or even lacking in many parts of the Upper Peninsula of Michigan, especially in the areas to the south of the highlands along the shore of Lake Superior, more particularly in the shelter of the Huron Mountains and the Copper Range.[4] Evidence that the higher parts of the Huron Mountains are driftless was presented as early as 1907. Davis[5] says: "The conclusions reached . . . are: (1) that there exists in northern Marquette County an area of several townships' extent which is almost without glaciation. This land rises to nearly or quite 2000 feet above tide in the higher parts, and is 100 to 200 feet lower in the valleys. (2) From the fact that the drainage was across this highland and followed preglacial rock valleys, while the ice was piled up around its outer margin, it is evident that this area must have been early abandoned by the local ice cap which covered it. (3) . . . It seems probable that the direct movement of the ice from the northeast was practically checked by the Marquette

[1] Conklin, G. H., *A correction, with additions*, Bryologist **31**: 33, 1928.

[2] Evans, A. W., *loc. cit.*, 1923.

[3] Conklin, G. H., *Report of the Curator of the Hepatic Department of the Sullivant Moss Society*, Bryologist **32**: 21–23, 1929.

[4] Leverett, Frank, *Moraines and shore lines of the Lake Superior region*, U. S. Geol. Survey Professional Paper 154-A, pp. 1–72, 1929.

[5] Davis, C. A., *Some interesting glacial phenomena in the Marquette region*, Rept. Mich. Acad. Sci. **9**: 132–135, 1907.

highland and by the Copper Range." It is intimated, in the same paper, that a similar condition may exist in parts of the Copper Range. Much of the interest in Davis's paper lies in the fact that the criteria used are geological rather than biogeographical. By still other authors, the summits of the Porcupine Mountains are considered to have emerged rather early from the thinning ice sheet, as attested by the distribution of till and erratic boulders.[1] They have not been considered as permanent nunataks, although perhaps the evidence might favor such an interpretation.

The flora of Isle Royale contains several species of curious and anomalous geographical distribution, although the western element does not seem to be as well developed as on the Keweenaw Peninsula. Critical study will perhaps reveal more species. Most of the significant bryophytes are really arctic-alpine ones, reaching a southernmost point here.[2] The distribution of only *Frullania Bolanderi* Aust. and *Orthotrichum Macounii* Aust. appears to be truly significant. The latter is distinctly western and is known from no other part of the eastern United States. Of course, there are several unusual phanerogams, also, of which the most spectacular is *Fatsia horrida* (Sm.) B. & H., known otherwise only from the northern Rockies and the Pacific northwest.

The presence of western forms on Isle Royale has been known for a long time, and has attracted considerable attention. In 1906 Ruthven[3] said: "The occurrence of these western and northwestern elements in the biota of Isle Royale is emphasized because . . . the majority of the species are those of the northeastern North American type. Whatever may be the explanation of the occurrence of these western and northwestern forms this far to the east, an important factor is, no doubt, the peneplain nature of the country, which probably formed an extensive highway for boreal forms along the ice margin during the retreat of the last ice sheet." Ruthven's assumption that the biota of Isle Royale migrated there in post-glacial times is undoubtedly correct, although the source of the plants, at least, need not have been the Rocky Mountains or the west coast, especially if Fernald's proposal is correct. Under any circumstances, the presence

[1] Van Hise, C. R. and C. K. Leith, *The geology of the Lake Superior region*, U. S. Geol. Survey Monogr. **52**: 1–641, 1911.

[2] Thorpe, Frances J. and A. H. Povah, *The bryophytes of Isle Royale, Lake Superior*, Bryologist **38**: 32–46, 1935.

[3] Ruthven, A. G., *An ecological survey in the Porcupine Mountains and Isle Royale, Michigan*, Ann. Rept. Geol. Survey Mich., 1905: 17–55, 1906.

of Cordilleran species of plants upon Isle Royale is rather remarkable, as the island is known to have been completely submerged under one or more of the relatively recent glacial lakes. Dr. George Stanley (who is probably more familiar than anyone else with the ancient shorelines of Lake Superior) tells me that the conspicuous beaches of Lake Algonquin can be found on the very highest parts of the island, so that a very small part of it, indeed, could have remained above Lake Algonquin, and that part not high. Furthermore, the beaches made still earlier by Lake Duluth are, on the mainland across from Isle Royale, some 200 feet higher than the adjacent Algonquin beaches, so that if Isle Royale was uncovered by an ice sheet, it must have been submerged many feet below the surface of that ancient lake.

In spite of the antiquity of the Algonquin beaches, as shown by the enormous amount of differential uplift which they have suffered, and the still greater age of the lake Duluth beaches, they are almost recent as compared to the Maumee or Arkona lakes, or even to Lake Whittlesey, whose beaches are so conspicuous in southeastern Michigan. It appears that the present flora of Isle Royale must have arrived there, not in interglacial or early postglacial times, but much more recently, in post-Algonquin and pre-Nipissing times. Dr. Stanley says (unpublished manuscript) that there was some as yet unexplained hiatus between Lakes Algonquin and Nipissing, so that the correlation between the two lakes is not well known. It is only in this long and incompletely understood period when Isle Royale first really emerged from the high-level post-glacial lakes that the present flora could have begun to invade the island. It is by no means difficult to believe, however, that the first isolated islands to appear above the ice or the glacial lakes might have received their first plant migrants from relatively close nunataks such as those of the Keweenaw Peninsula (if, for the sake of argument, we accept Fernald's conclusion) rather than from south of the ice border.

The history of the post-glacial Great Lakes is still incompletely understood, and is without doubt infinitely more complex than the already involved current explanations. The story of plant migrations in the Great Lakes region is inextricably bound up with the geological history of these lakes, and is certainly just as complex.

Many papers have been written on the ecology of bryophytes, and the influence upon them of their environment. Much work has also been done on the associations of bryophytes, but almost com-

pletely without regard to the geological history of the species, or even to its distribution as a whole. There are a few species whose present distribution really seems to be influenced by at least the most recent glaciation. When the puzzling distribution of *Bryoxiphium norvegicum* (Brid.) Mitt. is analyzed, it appears that the species occurs only in areas which have escaped glaciation.[1] The hepatic *Frullania Bolanderi* Aust. also has a remarkable distribution (Fig. 5). It is common on the west coast, but is also known from the unglaciated parts of the Gaspé Peninsula and from the highlands along the south shore of Lake Superior. In view of the small number of such species, the identification of a disrupted western element in the bryophyte flora of the Keweenaw Peninsula is probably important more as a simple demonstration that the distribution of bryophytes *does* parallel that of vascular plants, than as bearing on a possible lack of glaciation.

It has certainly not been commonly recognized that many species of mosses and hepatics have a significantly localized rather than a general distribution. Of course, there are so many exceedingly common or even weedy species, that "critical" distribution is usually obscured. From the distribution of such weedy bryophytes as *Marchantia polymorpha* L.[2] has come the popular belief in the wide and unlimited distribution and rapid dispersal of bryophytes. As a result, the field of bryogeography in North America has been almost completely neglected. Although several hundred papers have been published on the moss and hepatic floras of restricted areas, no one seems to have analysed the distribution of "critical" species (or any others) over the country as a whole. There are a few comparisons of the hepatic flora of North America with that of other *continents*,[3,4] but the exact identification of regional elements within this continent is not considered, in American literature, with the exception of some notable work done by Evans in New England and Bartram on the mosses of Central America and Mexico.

One commonly sees species labelled in lists or discussions, vaguely

[1] Steere, W. C., *Bryoxiphium norvegicum, the sword moss, as a preglacial and interglacial relic*, Ecology, 1937 (in press).

[2] Graff, P. W., *Invasion by Marchantia polymorpha following forest fires*, Bull. Torrey Bot. Club **63**: 67–74, 1936.

[3] Underwood, L. M., *The distribution of Hepaticae of North America*, Proc. Amer. Assoc, Adv. Sci. **39**: 298–304, 1891.

[4] Müller, K., *Die Lebermoose Deutschlands, Oesterreichs u. d. Schweiz* **2**: 803–860, 1916.

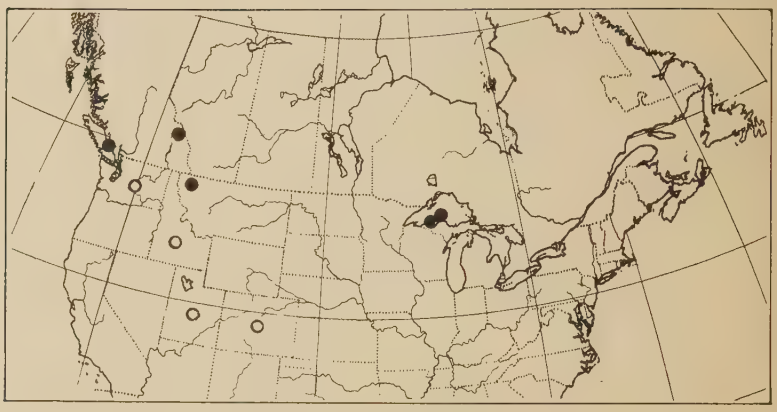

FIG. 3. Range of PSEUDOLESKEA OLIGOCLADA.

FIG. 4. AMERICAN RANGE OF JUNGERMANNIA SCHIFFNERI.

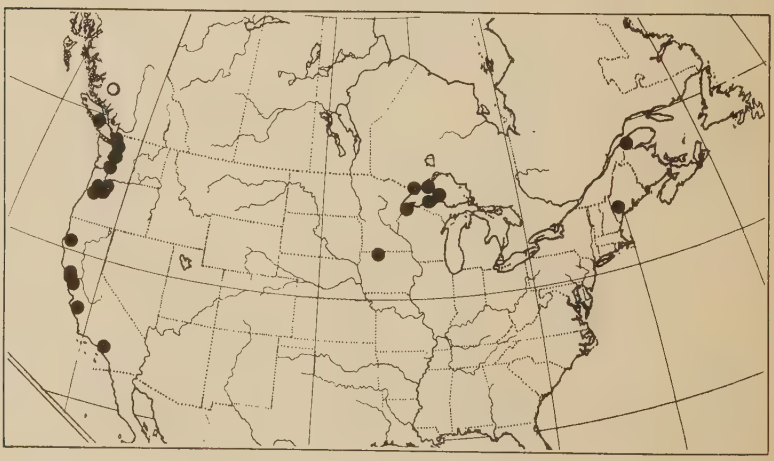

FIG. 5. Range of FRULLANIA BOLANDERI.

and often inaccurately, as "northern," "southern," etc. However, when the known geographical distribution of each species is carefully plotted on outline maps, much of the ambiguity and disorder is cleared up. It is not an overwhelming task to prepare such maps for the relatively small groups of the hepatics and mosses, and the illumination which they shed upon the distributional problems has more than repaid the writer's labor in making them. It has become clear that there are many well-defined floristic elements. It is exceedingly stimulating to discover, when reading over a paper on the distribution of flowering plants, in which the floristic elements are tabulated or mapped, that there are almost always exactly parallel species in the bryophytes. The situation is often masked by the presence of large numbers of non-critical, ubiquitous species.

Three floristic elements, each characterized by a disjunct distribution, can be identified tentatively in the Lake Superior region. (1) Arctic species which here reach their southernmost point. Examples of a moss and a liverwort are *Timmia austriaca* Hedw. (Fig. 1) and *Asterella Ludwigii* (Schwaegr.) Underw. (Fig. 2). (2) Species which are almost strictly Cordilleran, and usually characteristic of high altitudes. Examples of a moss and a liverwort are *Pseudoleskea oligoclada* Kindb. (Fig. 3) and *Jungermannia Schiffneri* (Loitles.) Evans (Fig. 4). (3) Species which are best known on the Pacific Coast, and usually characteristic of lower levels. An example of an hepatic is *Frullania Bolanderi* Aust. (Fig. 5). Another element, with which we are not directly concerned here, but which nevertheless is exceedingly significant in its distribution, is composed of Cordilleran species which are also found in "the" driftless area of Wisconsin, Iowa, Minnesota and Illinois. An example from the Hepaticae is *Asterella saccata* (Wahlenb.) Evans (Fig. 6).

It can be predicted with confidence, on the basis of studies and maps already made that many of the bryophytes will be found to fall into phytogeographic groups with as much precision as do the flowering plants, and furthermore, *into the very same groups.* The analyses will be possible only after the prolonged and careful collection of specimens in critical areas, and by determining centers of migration.

The topography of Keweenaw County is rather varied, so that a large number of different habitats are available for plants. One of the most conspicuous topographical features is the series of several parallel monoclinal ridges, with longitudinal valleys between them.

The ridges are usually relatively high, with a gradual slope to the north and generally a sheer cliff on the south side. The tops of most of the ridges are treeless and windswept; consequently almost barren of bryophytes. Two species which can be depended upon to occur in

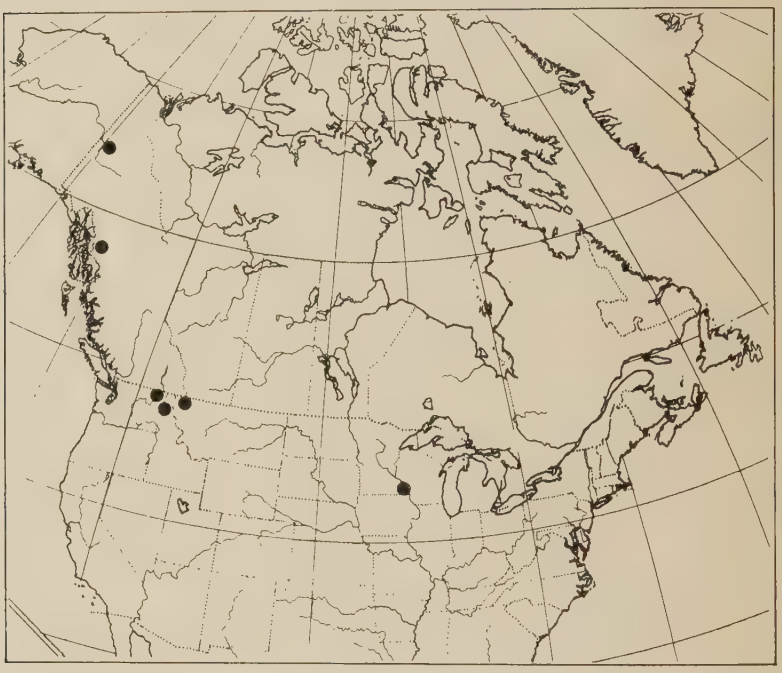

Fig. 6. American Range of Asterella saccata.

such situations, however, are *Tortula muralis* Hedw. and *Rhacomitrium canescens* (Timm) Brid.

Some high ridge summits in Keweenaw County in addition to West Bluff (735 feet above lake level), which was so thoroughly discussed by Fernald, are East Bluff (726 feet) and Lookout Point (728 feet). The highest point in the county appears to be on an unnamed ridge just north of Gratiot Lake. The altitude of this point is given[1] as 932 feet above lake level. Other high points are the two monadnocks, Mount Houghton and Mount Bohemia, with elevations of 877 and 867 feet, respectively. Most of these highlands have not been collected

[1] Board of County Road Commissioners, *Road Map of Keweenaw County*, blue print, 22 x 36 inches, 1934.

upon, because of their dryness, so that their bryophyte flora is almost completely unknown, although presumably of little interest.

The cliffs which are so prominent a feature of the linear ridges rather generally face to the south and receive maximum insolation. Consequently they harbor few bryophytes. The talus slopes below conglomerate cliffs are also relatively barren, partly because of their dryness and partly because of their mobility, although they are often well vegetated. The talus slopes of trap-rock cliffs, on the other hand, are among the most favorable habitats for bryophytes. Even the dry slopes exposed to the full force of the sun support xerophytes, as *Andreaea petrophila* Ehrh. and several species of *Grimmia*. On the shaded lower talus slopes, which have been invaded by the forest, are found many species of bryophytes in enormous quantities. The great rock fragments are covered with thick mats of mosses and hepatics, and the chasms between the blocks are often bridged by a carpet suspended only at the margins, a condition which is apt to result in embarrassment or damage to the unwary collector. Perhaps the most productive trap-rock cliffs are those extending for many miles on either side of the settlement appropriately named Cliff. The most important species which were found here, all in quantity, were *Metzgeria furcata* (L.) Dumort., *Tritomaria quinquedentata* (Huds.) Buch, *Orthotrichum strangulatum* Schwaegr., *Homalia Jamesii* Schimp., *Pseudoleskea oligoclada* Kindb., *Isopterygium Muellerianum* (Schimp.) Lindb., and *Rhytidium rugosum* (Ehrh.) Kindb.

The habitats which are richest in species of bryophytes are the sheltered bays or "harbors" along the northern shore of the Keweenaw Peninsula. On the sheltered, shaded conglomerate and trap-rock shores of Agate Harbor, Copper Harbor, and the less easily accessible Horseshoe Harbor are often solid carpets of mosses and hepatics. At the water level and to a foot or so above it are mats of *Leiocolea Gillmanni* (Aust.) Evans [*Lophozia Kaurini* (Limpr.) Steph.], *Scapania cuspiduligera* (Nees) K. Müll., and *Oncophorus virens* (Sw.) Brid. Farther up on the rock ledges are *Blindia acuta* (Huds.) Bry. Eur., *Hypnum arcuatum* Hedw., *Dicranoweisia crispula* (Hedw.) Lindb., *Brachythecium plumosum* (Sw.) Bry. Eur., and *Grimmia alpicola* Hedw. var. *rivularis* (Brid.) Broth. Above the water level, but within the reach of spray and storm waves are species of a more mesophytic character. On the dry faces of the higher shore cliffs *Leiocolea heterocolpa* (Thed.) Buch, *Saelania glaucescens* (Hedw.) Broth., and *Encalypta ciliata* (Hedw.) Hoffm. are not uncommon.

In the moist forest along the lake shore, mosses and hepatics cover the ground and boulders in a thick mat. The most important species are *Lophozia incisa* (Schrad.) Dumort., *L. longidens* (Lindb.) Macoun, *L. Hatcheri* (Evans) Steph., *L. Kunzeana* (Hüben.) Evans, *L. obtusa* (Lindb.) Evans, *L. attenuata* (Mart.) Dumort., and *Tritomaria quinquedentata* (Huds.) Buch. The disjunct western species, *Timmia austriaca* Hedw., was locally common in a few places at the edge of the forest just above the rocky shore ledges. Most of the swamps and bogs were too dry to make satisfactory collecting or even survey work possible, so that the work in these habitats was postponed until a more favorable season.

(*To be continued*)

THE TYPIFICATION OF ACALYPHA VIRGINICA L.

C. A. Weatherby

Acalypha virginica has no original diagnosis in the Species Plantarum. It rests on citations from the Hortus Cliffortianus, Flora Zeylanica and Hortus Upsaliensis of Linnaeus, from Plukenet and from Gronovius. There is a specimen in the Linnaean herbarium, presumably there in 1753 and labelled by Linnaeus "1 virginiana." In the Hortus Cliffortianus, there is a brief original diagnosis, or rather phrase-name, insufficient to determine what Linnaeus had before him; but there is no specimen in the Clifford herbarium. There is no original diagnosis in the Hortus Upsaliensis. The citations from Plukenet and Gronovius are represented by specimens.

When I revised the group of *A. virginica* in 1927[1] I had seen none of the above specimens. I had before me the statement of Mueller Argovensis[2] that the specimen in the Linnaean herbarium represented the plant of the Upsala garden and certain notes most generously lent me by Dr. S. F. Blake who had himself been interested in the group and who had looked up the material in the herbaria at London. These notes stated that although, as I pointed out, Plukenet's figure resembled rather *A. virginica* β *intermedia* Muell. (*A. digyneia* Raf.), the specimen back of it was actually *A. virginica* α *genuina;* also that Clayton 201, on which the Gronovian citation rests, was *A. virginica*

[1] Rhodora, xxix. 193–204 (1927).
[2] in DC. Prod. xv. pt. 2, 869 (1866).

β *intermedia*. On the basis of the two statements, that the specimen in the Linnaean herbarium represented the plant of the Upsala garden, which Linnaeus of course had seen, and that the plant of Plukenet was the same, I accepted Mueller's application of the name *A. virginica* to the species to which the Linnaean specimen belongs and took up *A. digyneia* Raf. for that represented by Clayton 201.

In 1928, Mackenzie pointed out[1] that the Linnaean specimen was wholly without data and that Mueller's confident assertion rested on inference only—probable enough, but still no more than inference. And last fall, when I had an opportunity myself to examine the specimens concerned, I found that Dr. Blake had apparently been the victim of an unfortunate and unsuspected accident. For the specimen in Plukenet's herbarium (herb. Sloane, vol. 96, fol. 188) labelled with the phrase-name cited by Linnaeus, indexed by Sloane as the original of plate 99, figure 4, and corresponding so exactly to that figure that there can be little, if any, doubt that the artist worked from it, is not at all *A. virginica* of my treatment but very good *A. digyneia*. In all respects—shape of leaves, relative length of blade and petiole, presence of long, spreading hairs on the stem, number and shape of lobes and type of pubescence of the bract, and length of the staminate spike—it is so excellent an example of that species that I cannot suppose that Dr. Blake, who understood the entities concerned as I do, could have determined it otherwise except by some slip. Incidentally, two other specimens in the herbarium of Plukenet bearing the same phrase-name, are also *A. digyneia*. So is Clayton 201; here Dr. Blake's determination met with no mishap.

This puts a very different face on the matter of typification. The specimen of Linnaeus is now shown to represent certainly nothing but a determination made by him; Plukenet's specimen is not the same. The citations from him and from Gronovius are perfectly consistent. There is nothing but the citation from Plukenet, common to both, to indicate the identity of the plants of the Hortus Cliffortianus and Hortus Upsaliensis. Everything which can be definitely associated, as an original, with *A. virginica* L. is *A. digyneia* Raf. Under the circumstances there seems no other course than to transfer the Linnaean name to that species and to take up for *A. virginica* of my treatment the first clearly applicable name, *A. rhomboidea* Raf. This has already been done by Small, Man. se. Fl. 786 (1934).

[1] Rhodora, xxx. 236 (1928).

Mackenzie arrived at the same conclusion, but by a route I should not have followed. He selected the Clayton specimen as the type and said he would have done so even had that of Linnaeus been certainly the plant of the Upsala garden. To this, I should not have agreed; but since the plant of the Linnaean herbarium is not authentic, I must accept Mackenzie's conclusion if not his argument.

The nomenclature and synonomy of the two species concerned now become:

Acalypha rhomboidea Raf. New Fl. i. 45 (1836). *A. caroliniana* Walt. Fl. Car. 238 (1788)? (nomen dubium); certe sensu Michx. Fl. Bor.-Am. ii. 216 (1803). *A. crenulata* Raf. op. cit. 44 (1836), quoad synonyma citatum. *A. virginica* α *genuina* Muell. Arg. Linnaea, xxxiv. 44 (1845). *A. virginica* sensu Weatherby, Rhodora, xxix. 194 (1927), non L. (1753).

Var. **Deamii**, comb. nov. *A. virginica*, var. *Deamii* Weath. Rhodora, xxix. 197 (1927).

A. virginica L. Sp. Pl. 1003 (1753), excl. syn. Fl. Zeyl. *A. digyneia* Raf. Fl. Lud. 112 (1817); Weath. Rhodora, xxix. 198 (1927). *A. crenulata* Raf. New Fl. i. 44 (1836), quoad plantam descriptam? *A. brevipes*, var. *pubescens* Raf. l. c.? *A. virginica* β *intermedia* Muell. Arg. Linnaea, xxxiv. 45 (1865).

Gray Herbarium.

PRESERVATION OF PLANT MATERIAL IN NATURAL COLORS

Francis J. Scully

While the usual method of preparing herbarium specimens by drying and pressing the plant material has been satisfactory for preservation and identification, there is no doubt that the preservation of the natural color of the flowers and foliage would facilitate the identification of the specimens and differentiation of closely allied species. It is true that the newer method of rapid drying in controlled heat retains more of the natural color of the foliage and flowers, but the normal appearance of the floral parts is altered by the pressing.

Various solutions have been employed to preserve plant material, but most of them have had the disadvantage of decolorizing the foliage as well as the flowers. During the past three years I have tried out a number of solutions and formulae with some success, which is reported here.

As a rule only the flowers of the plants were selected for preservation, along with a typical leaf. If the flowers and leaves were large only a single flower and leaf were used, if small a typical portion of the inflorescence was used. Small cylindrical capsule vials one inch in diameter were used as containers. These have a wide mouth, closed by a bakelite screw cap. The height varied from two to four inches, the size used depending on the size of the plant specimen. The same containers have been used for all the experimental work except for a few very large specimens.

The solutions employed were alcohol, formaldehyde, sodium benzoate, hexylresorcinol solution, merthiolate, and several formulae selected from a list furnished through the courtesy of Mr. M. H. Haller of the United States Department of Agriculture. Haller collected a number of formulae from the literature, but states that his experience with them was limited, and that he had employed only one or two of them mainly in the preservation of fruits. Two of these formulae were finally found to give fair success with flowers, and will be designated as formula "A" and formula "B."

Alcohol has long been used as a preservative but did not prove at all suitable for plant material. The flowers and foliage were not only decolorized but became shrunken, due to the dehydrating action of the alcohol. Formaldehyde was used in various strengths, ranging from 1% to 5%, with good preservation of the material but leaving it completely decolorized or somewhat brownish. Sodium benzoate in 2% solution was tried. This solution has long been used to preserve the natural color of vegetables and fruits which have been cooked, but it did not preserve the color of the raw plant material, and had the disadvantage of making the specimen soft and flabby so that it sagged to the bottom of the vial. The same results were obtained with hexylresorcinol. Merthiolate, a mercurial, germicidal preparation was tried in dilutions ranging from 1–1000 to 1–20,000. The stronger solutions gave better preservation, but all dilutions caused a blotchy bluish-green discoloration of the flowers and tender leaves. However, the color preservation was better than with the solutions previously mentioned.

Formula "A" consisted of a single solution, made up as follows:

Sulphurous Acid	15 cc	Copper Sulphate	15 gm
Boric Acid	15 gm	Water to	1000 cc

Formula "B" was made up of two solutions. Solution one consisted of:

5% Solution Copper Sulphate

Solution two consisted of:

Commercial Sulphuric Acid	16 cc
Sodium Sulphite	21 gm
Water to	1000 cc

In using formula "B" the vials were filled with solution one and allowed to remain on the specimens twenty-four hours to set the colors. After washing several times in water the vials were then filled level full with solution two and sealed tightly. The vials were stored upright to prevent any possible leakage. From time to time the vials were checked and if the solution had become low more was added. Rarely some clouding occurred in the vials, particularly if the plant material was thick or if solid green fruits, such as those of the crataegus, had been preserved. When this occurred the solution was changed and the specimen washed with water if necessary.

This formula has given good results in over 600 specimens collected during the past two years. The specimens appear as fresh as new material, the green color being clear and vivid, and the material firm and rigid. The normal shape was retained in most instances, except for the rolling of the petals in slender-rayed *Compositae* and in very fragile flowers such as those of *Portulacaceae* and *Commelinaceae*. Yellow flowers, especially of the *Compositae*, retained their color quite well but the more delicate shades of pink and blue, particularly in the fragile *Violaceae* and *Scrophulariaceae* faded out quickly and completely, often leaving the flowers transparent, showing the stamens and pistil through the corolla. Dark reds in both flowers and fruits faded out when preserved in this solution. This also occurred with dark blue fruits, the solution becoming so colored that it was difficult to see the specimens. It has not been quite as satisfactory for comparison between species, though the specimens are well preserved and can be removed from the vials and washed for inspection. It has proven better to use well developed fruits that are green than to use mature, highly colored fruits.

In checking over the specimens, the best results appear to have been obtained with grasses, sedges and rushes, which are entirely green. Good results were also obtained with the *Compositae*, *Labiatae*, *Polygonaceae* and *Cruciferae*. Except for the loss of color in the flowers

of the *Violaceae, Scrophulariaceae* and *Rosaceae*, the specimens are well preserved and have retained their normal shape.

Formula "A" also gave good results, but the solution was not as clear and the colors were not as well retained. However, it has the advantage of requiring no changing of solutions or handling of the specimens after they are once placed in the vials. Where it is not practical to change fluids, such as on field trips or where the facilities are not at hand, this method has been quite satisfactory. Vials filled with this solution can be carried on expeditions to preserve flowers and fruits that are likely to be crushed or altered in pressing and drying. Later these specimens can be removed for study along with the dried specimens and are of considerable aid in making determinations. For permanent preservation, however, formula "B" has given the best results.

The natural color of the preserved specimens makes easier identifications than the use of the dried, pressed specimens alone. Instead of a flat surface, as in the usual herbarium specimens, a three dimensional view is given. Comparing specimens to see if they are identical or not is made easier with this method, the small vials being more easily handled than the larger herbarium sheets. The natural green color of the foliage and the color of the flowers, where retained, give a more natural appearance to the specimens. Pubescence can readily be seen by holding the specimens in front of a light and viewing with a hand lens. Should it be necessary the specimens may be removed from the vials, washed with water, and studied. The firmness of the plant material is retained quite well.

This method of preserving plant material is not intended to take the place of the usual method for preparing herbarium specimens, but it is suggested as an additional aid in the identification and study of plant specimens. While the present formulae have given fair success, there is no doubt that further study will improve the solutions and add to their value.

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VARIANTS IN TWO SPECIES OF DELPHINIUM

Lily M. Perry

When the herbarium material of *Delphinium carolinianum* and *D. virescens* came to hand to be put in order, my attention was directed to the variation in the pubescence of the stems. Two types of trichomes may be present either on the same or on different plants: the one white, crisp, retrorse and closely appressed to the stem; the other yellowish, with bulbous base (glandular) and spreading, nearly or quite at right angles. Since apparently, in the material at hand, the relative position of these on the stem is correlated with a definite geographical range, the following varieties are proposed.

a. Seeds wing-margined with rugose, slightly (if at all) squamellate sides; spur 1½ times the length of the upper sepal; flowers prevailingly blue (at times whitish)....*b.*
b. Upper part of stem glandular-pubescent, lower usually crisp-pubescent (at times glandular).
Pubescence not copious; seeds winged, rugose.
D. carolinianum (typical).
Pubescence copious (tending to be floccose); seeds strongly winged, markedly rugose.....Var. *Nortonianum.*
b. Both upper and lower part of stem crisp-pubescent.....Var. *crispum.*
a. Seeds not wing-margined but usually more or less angled, with strongly rugose-squamellate sides; spur 1½–twice the length of the upper sepal; flowers prevailingly white or whitish (at times bluish)....*c.*
c. Stem in some part glandular-pubescent.
Upper part of stem glandular-pubescent, lower crisp-pubescent.....*D. virescens* (typical).
Upper part of stem crisp-pubescent, lower glandular-pubescent.....Var. *Penardi*
c. Stem crisp-pubescent throughout.....*D. vimineum* (typical).

D. carolinianum Walter, Fl. Car. 155 (1788). *D. azureum* Michx. Fl. Bor.-Am. i. 314 (1803); Deless. Ic. i. t. 60 (1820). Georgia: Augusta, June, 1888, *G. McCarthy;* Athens, *L. M. Perry,* nos. 862, 863; Chickamauga Park, May 27, 1911, *J. R. Churchill;* without data, *Neisler.* Kentucky: barrens, *C. W. Short.* Missouri: southeast of Cedar Gap, *O. E. Lansing,* Jr., no. 3073. Louisiana: Red River, *Hale.* Texas: Mineola, *J. Reverchon,* no. 4341; Grand Saline, *J. Reverchon,* no. 3699; vicinity of Huntsville, *R. A. Dixon,* no. 356; Sefkey Swamp, Gonzales Co., *V. L. Cory,* no. 5683; 12¼ miles north of Bracketville, *V. L. Cory,* no. 6103.

Var. **Nortonianum** (Mackenz. & Bush), comb. nov. *D. Nortonianum* Mackenz. & Bush in Trans. Acad. Sci. St. Louis, xii. 82 (1902). *D. azureum,* var. *Nortonianum* Palmer & Steyermark in Ann. Mo. Bot. Gard. xxii. 543 (1935). Missouri: Monteer, *B. F. Bush,* no., 377; 1 mile west of Mansfield, *O. E. Lansing,* Jr., no. 3133.

With the few specimens at hand it is hard to tell the real differences

between this and the typical variety. The seeds are slightly larger in the specimen at hand. Whether they would always average so is a matter requiring either field observation or some further collections of at least nearly mature seeds.

Var. **crispum**, var. nov. Caule pubescente pilis retrorsis crispatisque. ILLINOIS: Milroy, July 7, 1908, *H. A. Gleason* (TYPE in Gray Herb.); Warsaw, June 17, 1847, *S. B. Mead.* MISSOURI: between Springfield and St. Louis, *S. D. McKelvey*, no. 2526; Eagle Rock, *B. F. Bush*, no. 228; Swan, *B. F. Bush*, no. 188; Greene Co., May 31, 1888, *J. W. Blankinship.* ARKANSAS: Prescott, *B. F. Bush*, no. 253. OKLAHOMA: near Page, *O. W. Blakley*, no. 1419; Howe, *E. J. Palmer*, no. 39,341.

None of the specimens here cited have mature seeds. The flowers may be blue or whitish; all stems lack the glandular pubescence characteristic of typical *D. carolinianum.*

D. VIRESCENS Nutt. Gen. ii. 14 (1818). *D. albescens* Rydberg in Bull. Torr. Bot. Cl. xxvi. 583 (1899). WISCONSIN: St. Croix Falls, July 3, 1899, *Mrs. N. E. Baker.* MANITOBA: Winnipeg Valley, 1859, *Bourgeau;* Lake Winnipeg, *Houghton.* MINNESOTA: St. Anthony, July 12, 1888, *J. H. Schuette;* Minneapolis, *J. H. Sandberg*, no. 280. IOWA: Fayette, June 25, 1894, *B. Fink;* Decatur Co., June 16, 1896, *T. J. & M. L. Fitzpatrick.* MISSOURI: Watson, *B. F. Bush*, no. 8; Westport, *B. F. Bush*, no. 613. NORTH DAKOTA: Fargo, July 9, 1909, *H. F. Bergman.* SOUTH DAKOTA: Interior, *E. J. Palmer*, no. 37,629. NEBRASKA: on Middle Loup River, near Thedford, *P. A. Rydberg*, no. 1360; Neligh, June 3, 1896, *E. S. Bacon.* KANSAS: prairies, Riley Co., *J. B. Norton*, nos. 8, 8a. OKLAHOMA: west of Tulsa, *S. D. McKelvey*, nos. 2501, 2514; near Alva, *G. W. Stevens*, no. 551. TEXAS: Tarrant Co., *A. Ruth*, no. 374; Victoria, *S. M. Tracy*, no. 9243.

This species is said to have a stouter habit than *D. carolinianum* and in the herbarium material here that is true; on the other hand, I distinctly recall practically covering an entire rolling slope where *D. carolinianum* was rampant before I found plants small enough to make good herbarium specimens. Color of the flower is not reliable except in combination with other characteristics. A number of specimens of *D. virescens* have decidedly hooked spurs, others (but not all) show a definite tendency in that direction. Perhaps the best distinguishing feature is found in the mature (or nearly mature) seeds; unfortunately not a quarter of our specimens have reached that point of development; consequently, in a group with not too definite specific lines, it is difficult to determine such collections.

Var. **Penardi** (Huth), comb. nov. *D. Penardi* Huth in Helios, x.

34—repr. Delph. Art. Ber. Staat. 10 (1892) and in Bull. Herb. Boiss. i. 335, t. 16, fig. 2 (1893). Differs fron the typical variety in having the lower part of the stem glandular-pubescent and the upper crisp-pubescent. Nebraska: Callaway, June 15, 1901, *J. M. Bates* in part. Kansas: prairie, Ellis Co., June 16, 1882, *G. C. Deane;* east of Liberal, *S. D. McKelvey*, no. 2491. Oklahoma: near Shattuck, *R. L. Clifton*, no. 3127. Colorado: New Windsor, June 21, 1905, *G. E. Osterhout;* Poudre Flats, north of Fort Collins, June 27, 1895, *J. H. Cowen;* along railway west of Fort Collins, June 20, 1896, *C. S. Crandall;* Denver, *I. W. Clokey*, no. 3091. Texas: Amarillo, *J. Reverchon*, no. 2959; Comanche Spring, New Braunfels, etc., *Lindheimer*, no. 660.

There are also two specimens collected at Noel, Missouri, by *B. F. Bush.* The lack of mature seeds in most of these specimens is a decided handicap in any effort to determine them.

D. vimineum Don in Sweet, Brit. Fl. Gard. ser. 2, iv. t. 374 (1838). Texas and Mexico.

This species so closely resembles *D. virescens* in habit that I mention it here. Although it differs in the crisp-pubescent stem, occasionally somewhat bluer flowers and darker brown seeds, further collections may prove it is not more than a variety of *D. virescens.*

Gray Herbarium.

NOTES ON THE DISTRIBUTION AND HYBRID ORIGIN OF × SOLIDAGO ASPERULA

Richard H. Goodwin

(Plate 453)

In 1900 Graves[1] published a note on "a little-known New England golden-rod" which Professor M. L. Fernald considered satisfactorily referable to *Solidago asperula* Desf.[2] Concerning the nature of the plant Graves wrote, "Dr. Gray, to whom most of the Massachusetts specimens were submitted, classed them doubtfully as hybrids between *S. rugosa* Mill. and *S. sempervirens* L. Later students, however, have been more inclined to regard this form as entitled to specific rank." Since then, accumulating evidence from field observations has led botanists to agree with Dr. Gray. The seventh edition of Gray's Manual (1908) lists the plant as a probable hybrid between *S. rugosa* and *S. sempervirens.*

[1] Rhodora 2 (15): 57–59. 1900.
[2] Desfontaines, Cat. Hort. Paris ed. 3: 403. 1829.

FIG. A, SOLIDAGO SEMPERVIRENS. FIGS. B, C and D, × S. ASPERULA, showing intergradations between A and E. FIG. E, S. RUGOSA. All specimens from the reclaimed saltmarsh on the Charles River, Cambridge, Massachusetts, September 19, 1932.

In connection with the hybrid origin of × *S. asperula* Desf., the geographical distribution of this plant and of its two alleged parents is of interest. FIGURES 1, 2 and 3 show the northeastern distributions of *S. rugosa*, *S. sempervirens* and × *S. asperula* respectively.[1] Knowlton, Weatherby, and Ripley[2] listed *S. rugosa* as generally distributed and *S. sempervirens* and × *S. asperula* as maritime species. Inspection of the maps shows that the range of × *S. asperula* does not extend

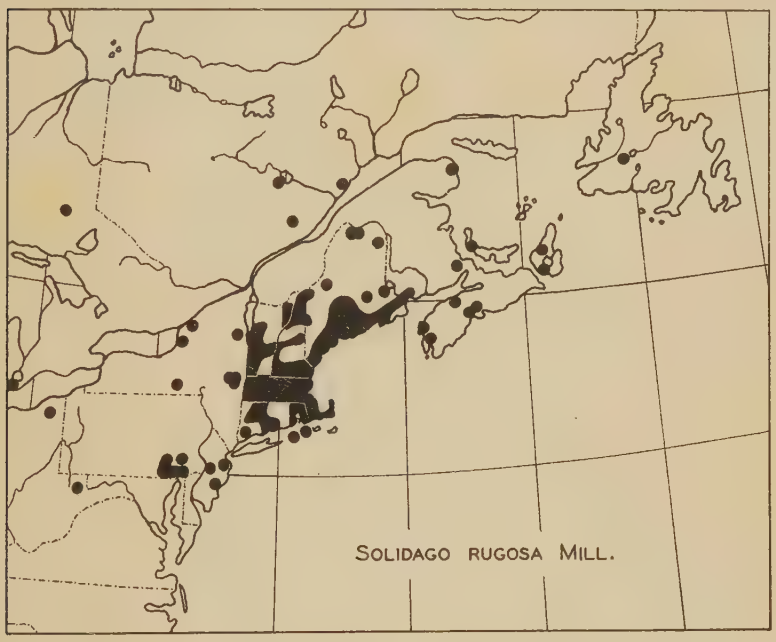

FIG. 1. Northeastern Occurrence of SOLIDAGO RUGOSA.

beyond that common to the two supposed parents. Notes on a large number of the more recent collections of × *S. asperula*, moreover, specifically mention the close proximity of both *S. rugosa* and *S. sempervirens*.

× *S. asperula* may be found most readily along the margins of salt-marshes adjacent to unmowed open land where *S. sempervirens* and *S. rugosa* are both flowering in abundance. Ideal conditions for

[1] Further collecting would undoubtedly extend the distribution of these plants as now shown on the maps. Specimens from the localities indicated may be found in the collections of the Gray Herbarium, of the New England Botanical Club, of Dr R. H. Wetmore, or of the author.

[2] RHODORA 27 (316): 56–65. 1925.

natural hybridization between *S. rugosa* and *S. sempervirens* were indirectly brought about in Cambridge, Massachusetts, by the closure of the dam at the mouth of the Charles River estuary in 1908. The subsequent ecological changes which took place in the flora of the salt-marsh between the Cambridge cemetery and the Charles River have been described by Mr. Walter Deane.[1,2] By 1912 considerable salt had been leached from the marsh.[1] Although most of the salt-

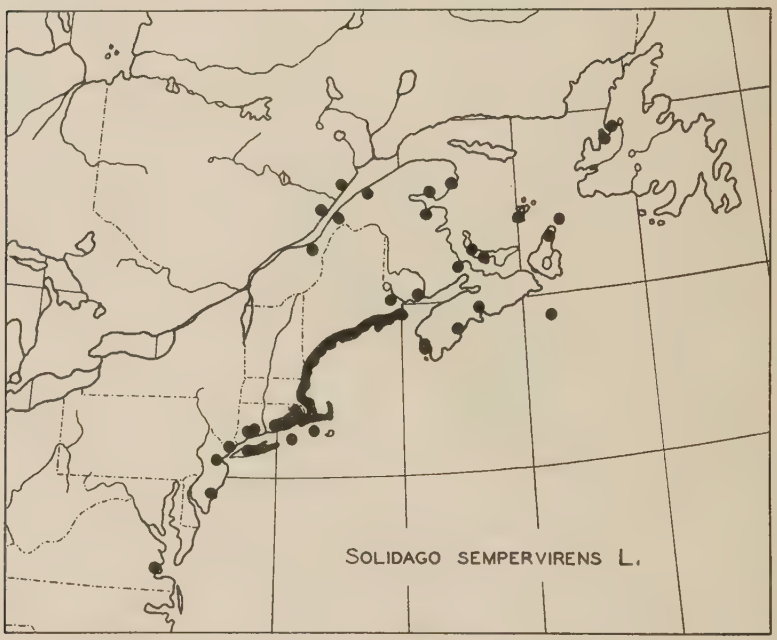

Fig. 2. Northeastern Occurrence of Solidago sempervirens.

marsh plants, including large stands of *S. sempervirens*, were still present, a host of weeds and fresh-water plants had already invaded the area. Among these was *S. rugosa*. In 1923 *S. sempervirens* was one of four maritime plants which Mr. Deane mentions as still persisting. Mr. Deane did not record × *S. asperula* in his original list nor in his supplement published in 1926. A number of specimens of this plant were collected from the area in 1923, however, by Dr. R. H. Wetmore, and it seems probable that it was growing there at an even earlier date. Figure 4 shows the distribution of *S. rugosa*, *S. semper-*

[1] Rhodora **17** (203): 205–222. 1915.
[2] Rhodora **28** (327): 37–40. 1926.

virens, and × *S. asperula* over this area in the fall of 1933. *S. rugosa* was common throughout; *S. sempervirens* was restricted to scattered patches; while × *S. asperula* was abundant, but most frequently associated with *S. sempervirens*. Furthermore, × *S. asperula* showed a tremendous variability, exhibiting many intergradations between *S. rugosa* and *S. sempervirens*, as shown in PLATE 453.

The foregoing evidence coupled with the many morphological

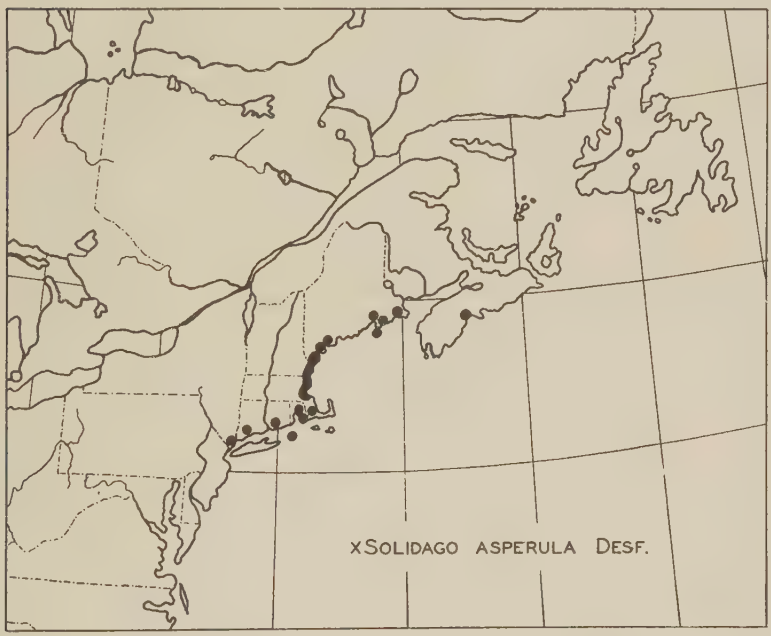

FIG. 3. Northeastern Occurrence of × SOLIDAGO ASPERULA.

characters intermediate between *S. rugosa* and *S. sempervirens* points to the hybrid origin of × *S. asperula*. The fact that these plants set abundant seed indicates that they are fertile and that second generation hybrids and back-crosses with the parents may occur.[1] This would account for the variability encountered in nature.

Genetical work carried out by the writer during the past five years has proved the validity of these conclusions. *S. rugosa* and *S. semper-*

[1] Since hybrid plants are usually sporadic in occurrence and have always been found growing close to their parents, back-crosses between hybrids and their parents should be far more frequent than second generation hybrids.

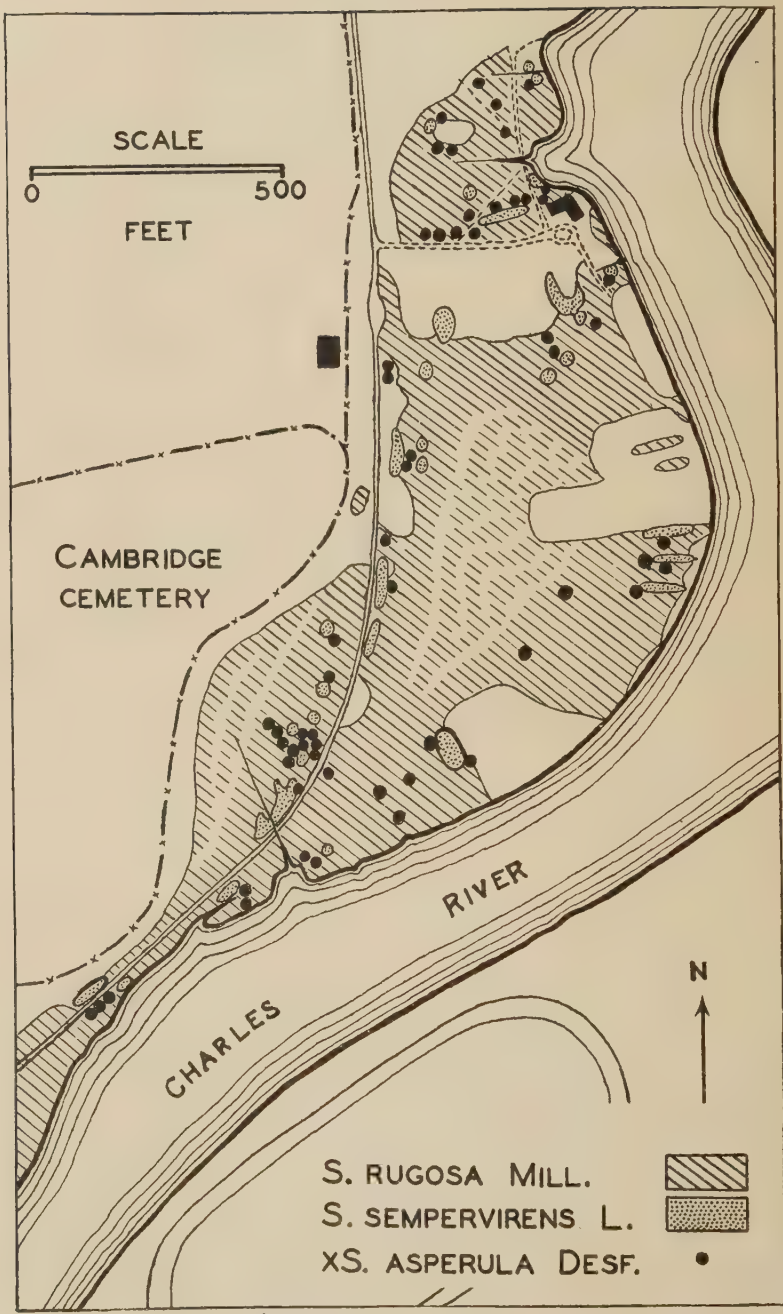

FIG. 4. Occurrence near Cambridge Cemetery of SOLIDAGO RUGOSA, S. SEMPERVIRENS and × S. ASPERULA.

virens[1] were used as stock material during the investigation. Pollinations were carried out in the greenhouse under carefully controlled conditions. The technique will be described in a subsequent paper. The results obtained were as follows:

1) F_1 hybrids were obtained from reciprocal crosses between *S. rugosa* and *S. sempervirens*. Their morphological and floral characters were intermediate between the parents and identical with those of typical plants of × *S. asperula*.[2]

2) Pollination experiments with these hybrids have proved them to be inter-fertile and self-sterile like their parents. A second generation has been brought to flower. Plants of the F_2 generation showed a complete range of intergradations between the two parental types.

3) Back-crosses were obtained between F_1 hybrids and both parents. These varied in appearance between the F_1 hybrid and the parent with which it was back-crossed.

This genetical evidence proves conclusively that × *S. asperula* is a hybrid between *S. rugosa* and *S. sempervirens*. Further, the variability of the second generation hybrids and back-crosses offers an explanation for the variability of × *S. asperula* in nature. The plants growing in an area such as the reclaimed salt-marsh on the Charles River display a complex of variable forms which might well confuse anyone who had not bred and grown these hybrids and back-crosses from seed.

Although *S. sempervirens* and × *S. asperula* are restricted to a maritime distribution, they have been grown from seed in the greenhouse and garden in light loamy soil just as successfully as has *S. rugosa*. Hence it would seem to be factors other than salinity which limit their distribution. The distribution of × *S. asperula* may not be confined to the immediate vicinity of salt water by ecological factors, as is generally the case with its maritime parent. Any spread of the hybrid inland, however, would result in these plants back-crossing exclusively with *S. rugosa*. In this way the characters of *S. sempervirens* would soon be swamped out.

[1] The original plants of *S. sempervirens* were obtained from pure stands on the sand dunes at Ipswich, Mass., while those of *S. rugosa* were collected on a high hill in Belmont, Mass.

[2] The description of × *S. asperula* Desf. in Gray's Manual, 7th edition, is adequate for genetical material grown by the writer in the greenhouse, except that the lowest cauline leaves of my specimens may reach a length of 3.6 dm. Graves' measurements are also correct except for these leaves. In nature the lowest cauline leaves have usually withered at the time of flowering and are frequently not present in herbarium material. Furthermore, there is a tendency for these plants to grow larger under greenhouse conditions.

Crosses between the various varieties of *S. rugosa* and *S. sempervirens* have not yet been attempted. It would be interesting to know whether *S. rugosa* var. *aspera* Fernald or *S. rugosa* var. *celtidifolia* Fernald naturally hybridize with *S. sempervirens* var. *mexicana* Fernald. These varieties all have a more southerly distribution on the Atlantic Coastal Plain.

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PETALOSTEMUM **occidentale** (Gray), comb. nov. *P. candidus*, var. *occidentalis* Gray in sched. Pringle Pl. Mex. no. 1216, and ex Heller in Britton & Kearney, Trans. N. Y. Acad. Sci. xiv. 33 (Feb., 1895), basis of *Kuhnistera occidentalis* Heller in Britton & Kearney, l. c. (Feb., 1895). *P. gracile*, var. *oligophyllum* Torr. in Emory, Notes Mil. Rec. 139 (1848). *Kuhnistera candida occidentalis* (Gray) Rydb. Contr. U. S. Nat. Herb. iii. 154 (Sept., 1895). *K. oligophylla* (Torr.) Heller, Bull. Torr. Bot. Cl. xxiii. 122 (1896). *Petalostemon oligophyllus* (Torr.) Rydb. Mem. N. Y. Bot. Gard. i. 237 (1900).

Treated as a species, the southwestern plant has to take the first specific epithet. In publishing *Kuhnistera occidentalis* in February, 1895, Heller definitely stated that he was deriving the name from one used on herbarium-sheets but unpublished by Gray. It seems proper, then, to cite Gray as the originator of the name.—M. L. FERNALD.

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